Rapid Ecological Assessment (REA) Survey Methodology:

#2. Fish Sizing and Counting

Coral Reef Ecosystem Program (CREP)

January 2016

Sizing and counting fish underwater

- Background – biomass

- Size estimation training

- Total length

- Aids to sizing fish

- Factors that can affect sizing
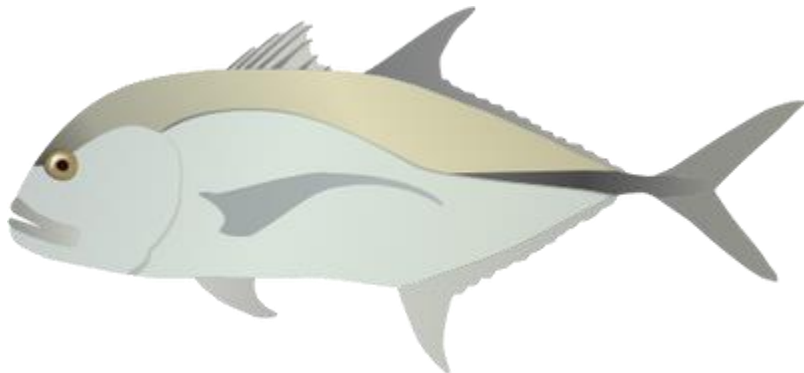
- Counting big schools

- Binning

Accurate fish sizing matters!

Why??

Size is used to estimate fish BIOMASS, the mass of living biological organisms in a given area or ecosystem at a given time.
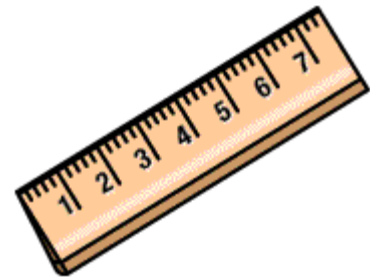
Background - biomass

$$W = a \times L^b$$

Biomass (Weight in grams) = a × Total Length (cm)^b

Estimating Biomass requires knowing the length-weight relationship for all the species sampled. The coefficients a and b are specific to each fish species, derived from numerous samples of hundreds of fish*.
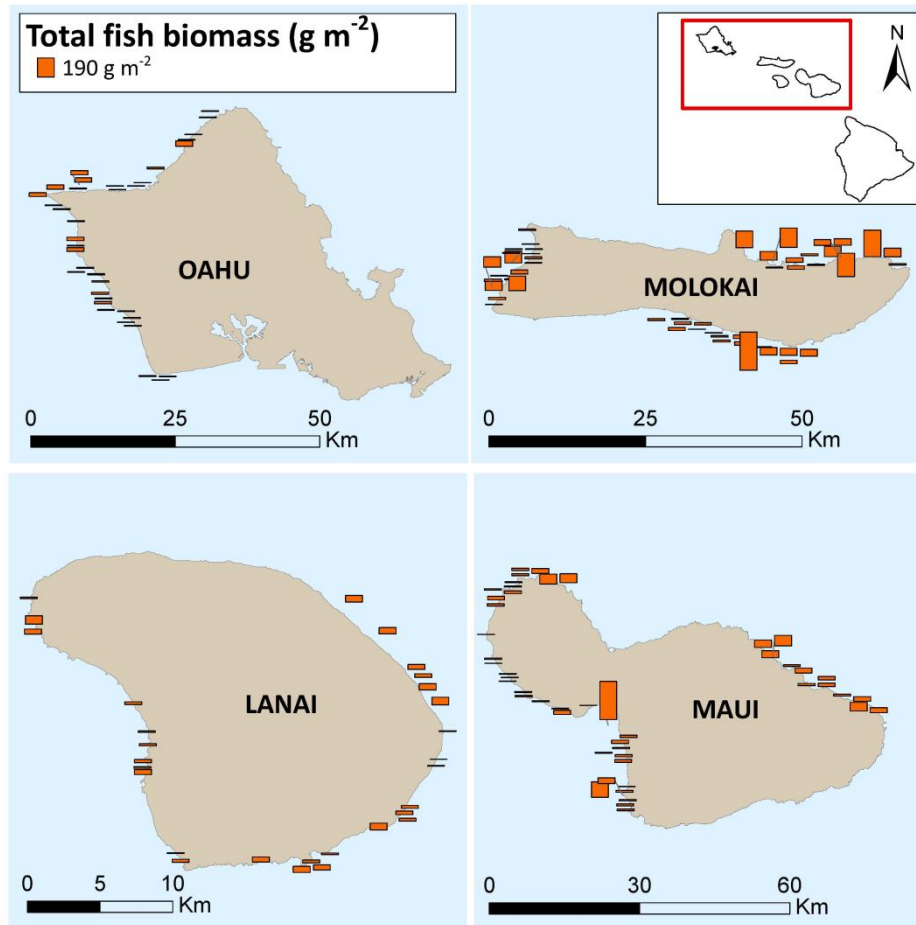
We're gathering data on "L."

*Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez. 1993. Length-weight relationships of fish from the lagoon of New Caledonia. Naga, ICLARM Q. 16(2-3):26-29.

Background - biomass

With the size and count data, we can come up with an estimate of how much fish biomass is around a given island or group of islands.
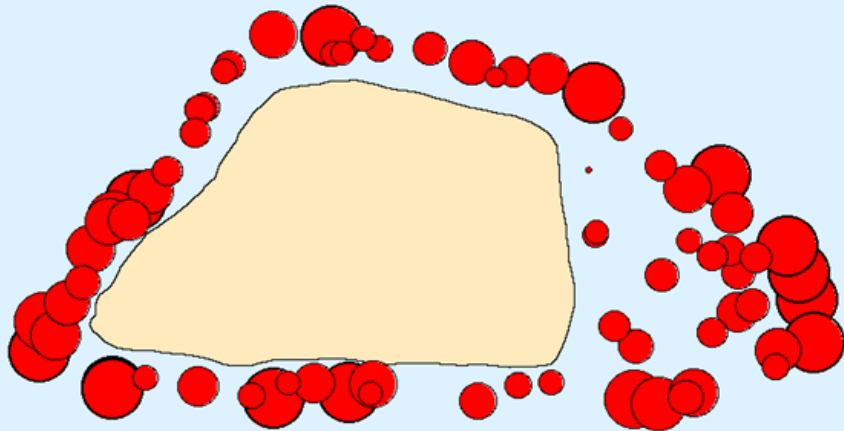
Background - biomass
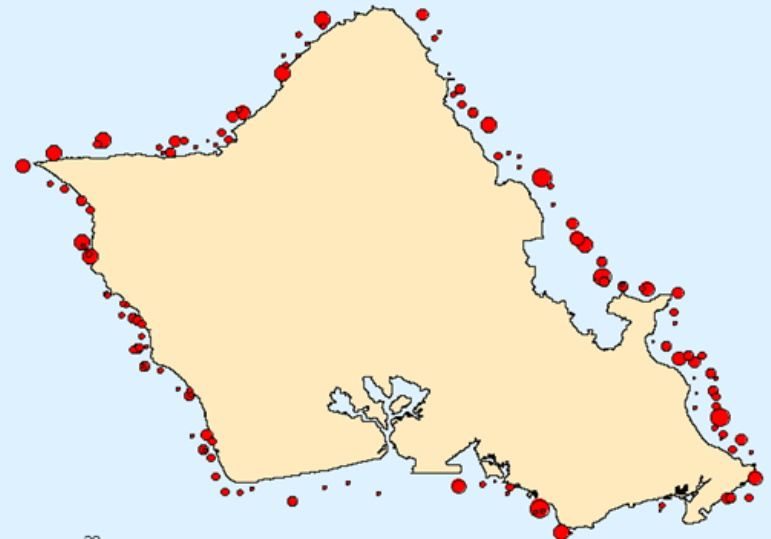
Example: remote vs. populated

Background - biomass

However, if sizing or counts are off, total biomass numbers will not be accurate.

The bottom map represents what the data would like if fish were oversized by 20% (e.g., a 100 cm fish was estimated incorrectly at 120 cm).

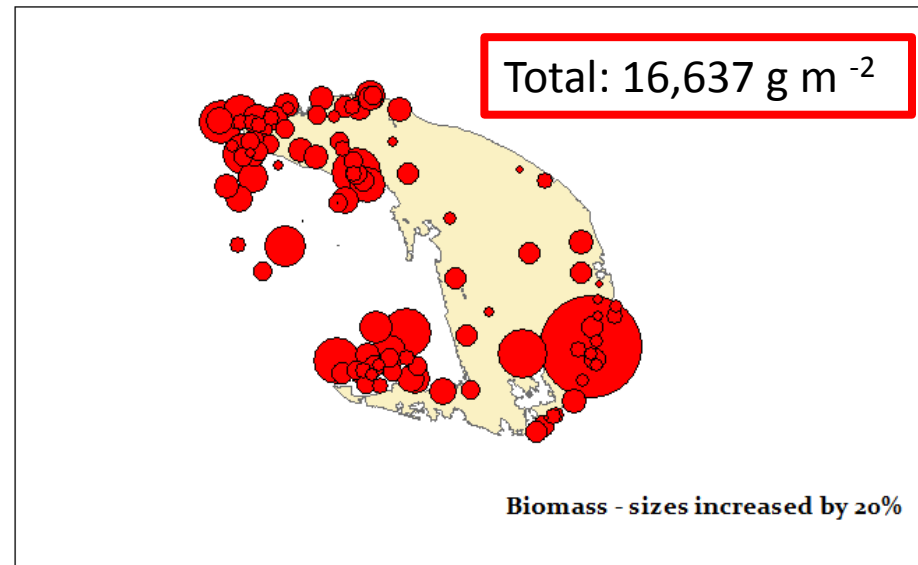If sizing is off by 20%, biomass is inflated by over 75%!

Size estimation training can help divers improve their estimates.

French Frigate Shoals   2007 - 2012

Total: 9,604 g m $^{-2}$

Biomass - from actual size data
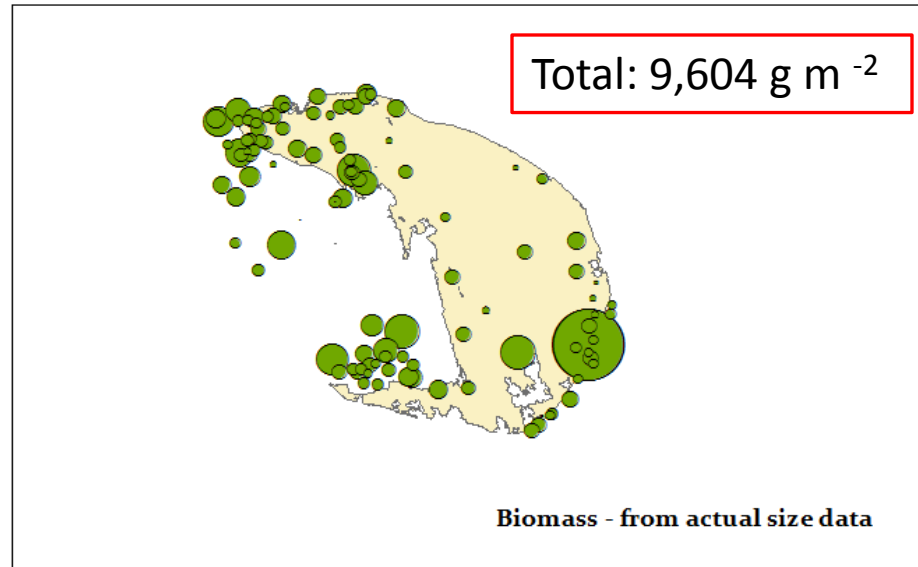
TOTAL FISH BIOMASS (g m $^{-2}$) $\circ$ 10 $\circ$ 50 $\bigcirc$ 500 $\bigcirc$ 1,000

Total: 16,637 g m $^{-2}$

Biomass - sizes increased by 20%

Size estimation training

Divers take part in fish sizing practice dives, which involves estimating sizes of fish models in a mock survey. These estimates are then compared against the real model sizes to evaluate the diver's performance.
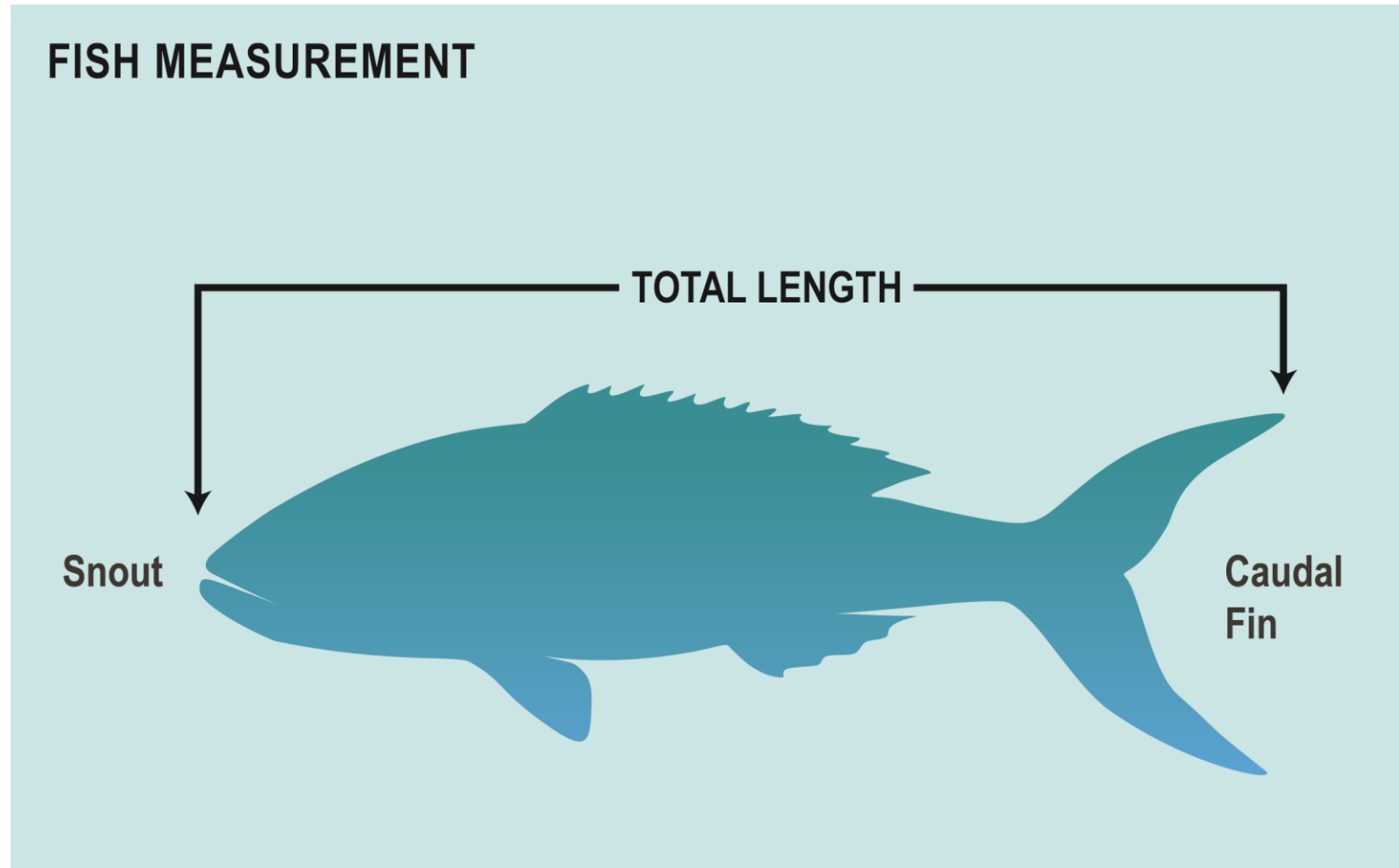
Size estimation training

Training results

The closer the divers are to the red 1:1 line, the more accurate their estimated sizes. Over time and continued monthly training, divers have been shown to improve their sizing estimates.
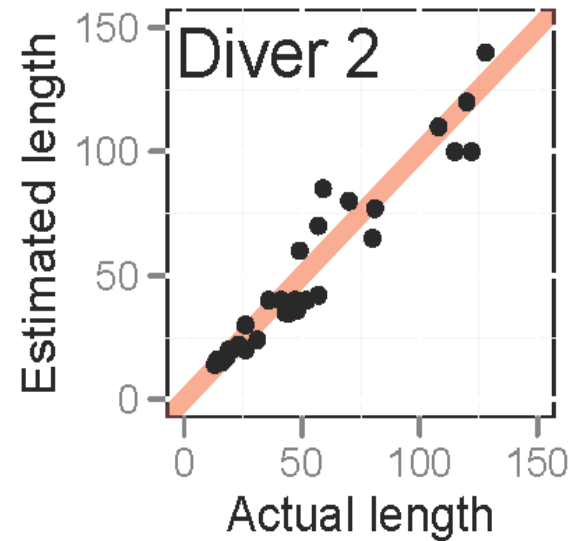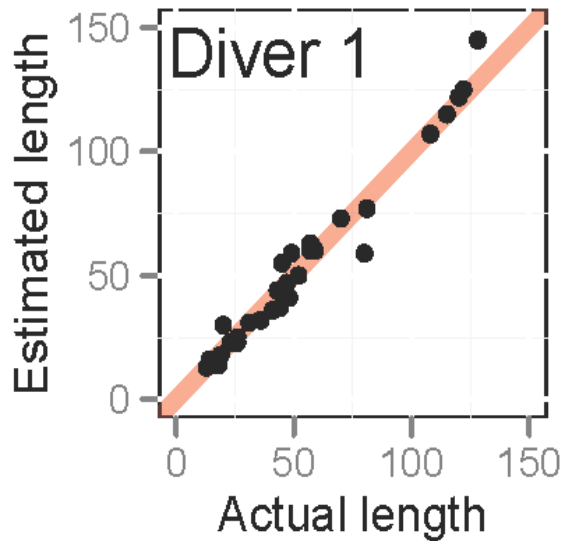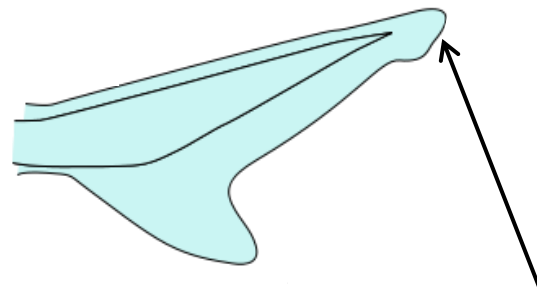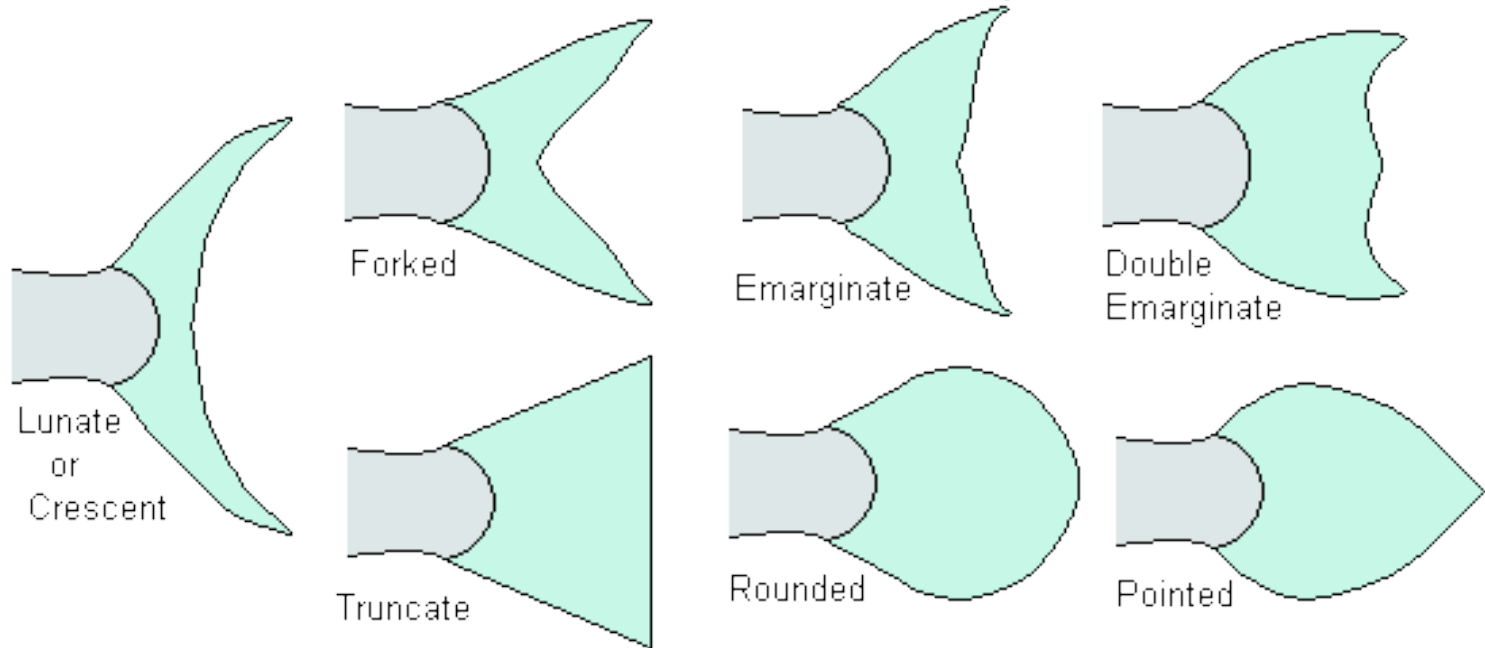
Total length

When you're estimating fish size, use total length: tip of the snout to the longest lobe of the caudal fin.
Estimate to the nearest centimeter.

Total length

Some Basic Fish Tail Shapes

Lunate or Crescent

Forked

Emarginate

Double Emarginate

Truncate

Rounded

Pointed

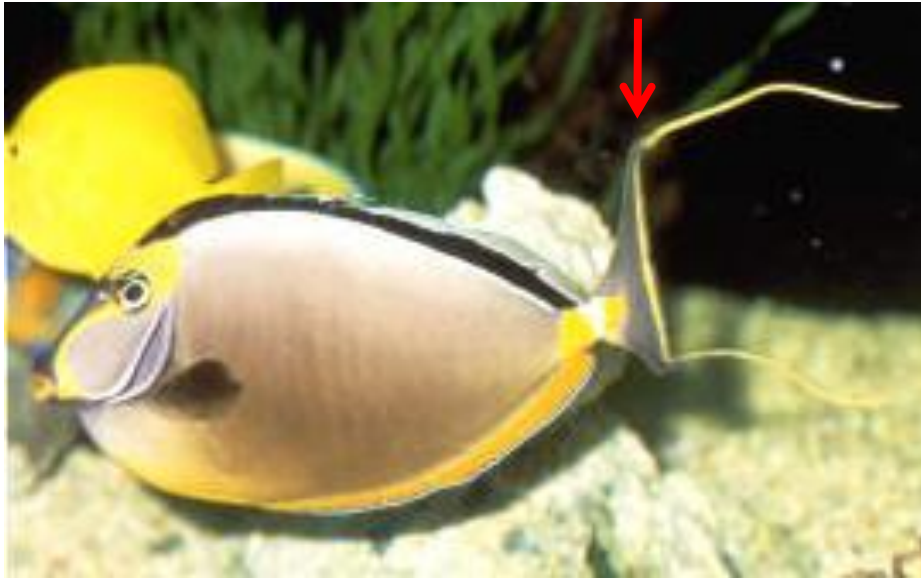Heterocercal tail: measure to the longest lobe.

Total length

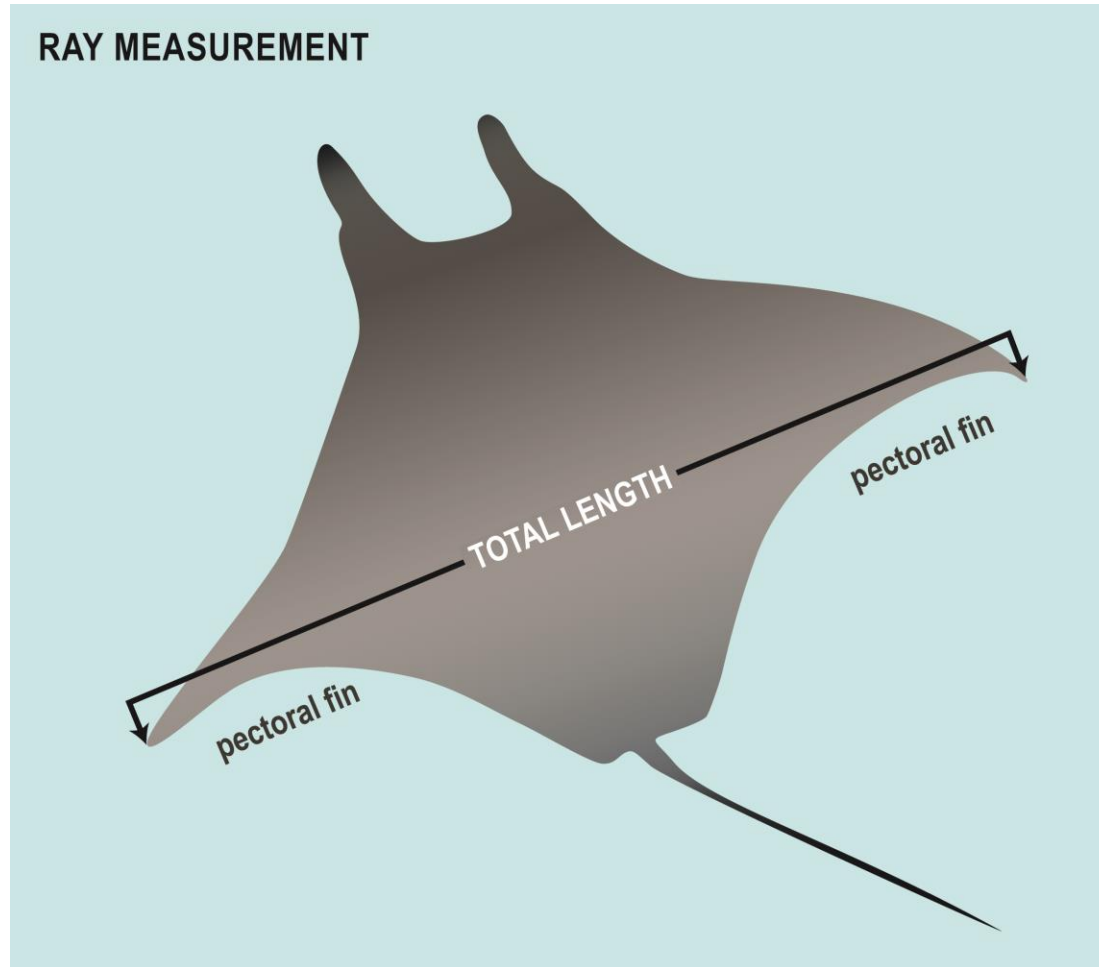Total length

Total length

Exception:

If the tail fin has streamers, don't include them.
Estimate where the fin would normally end.

Total length

Another exception:

For rays, size from pectoral fin tip to pectoral fin tip.

Aids to sizing fish

Some tools you can use underwater to help size fish

- Rules slate

- Meter stick

- Underwater landmarks

- Body measurements
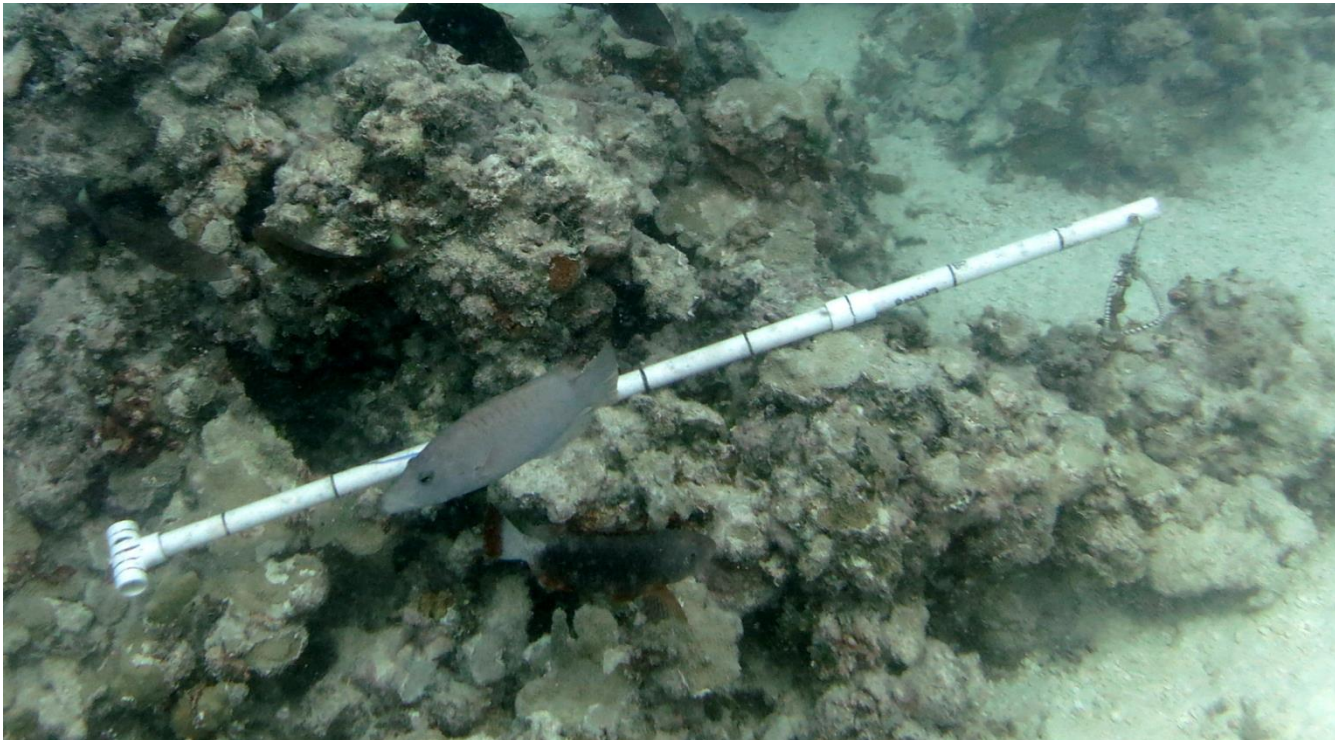
Aids to sizing fish

Ruled slate

Use the ruled edge of your slate as a reference.
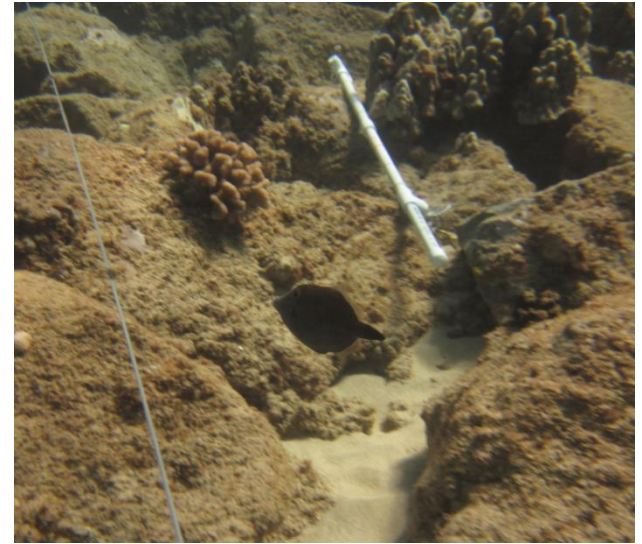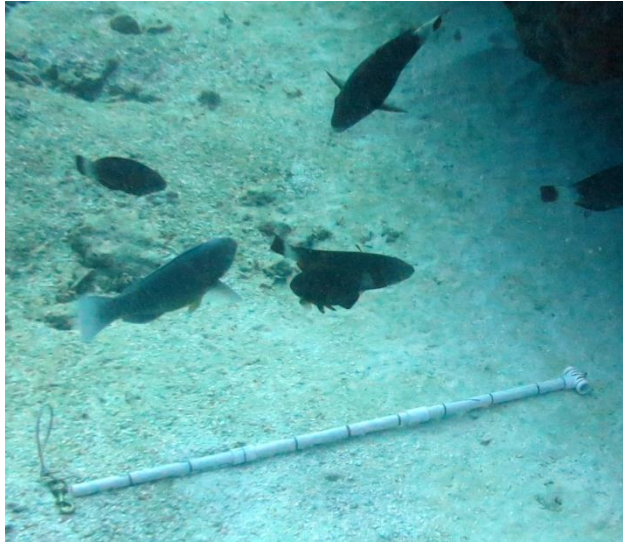
Aids to sizing fish

Meter stick

Carefully place your extended meter stick on the bottom for a visual reference of 10cm increments as fish swim nearby.
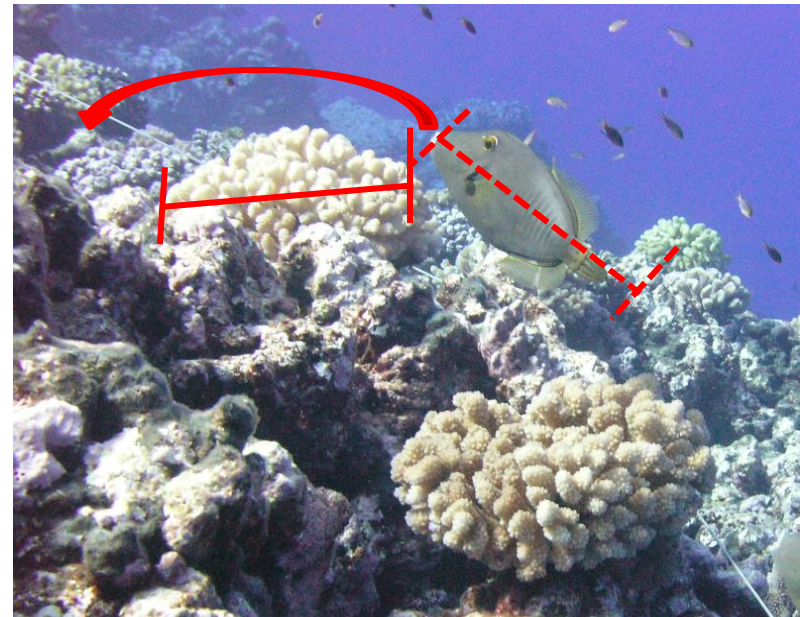
Aids to sizing fish

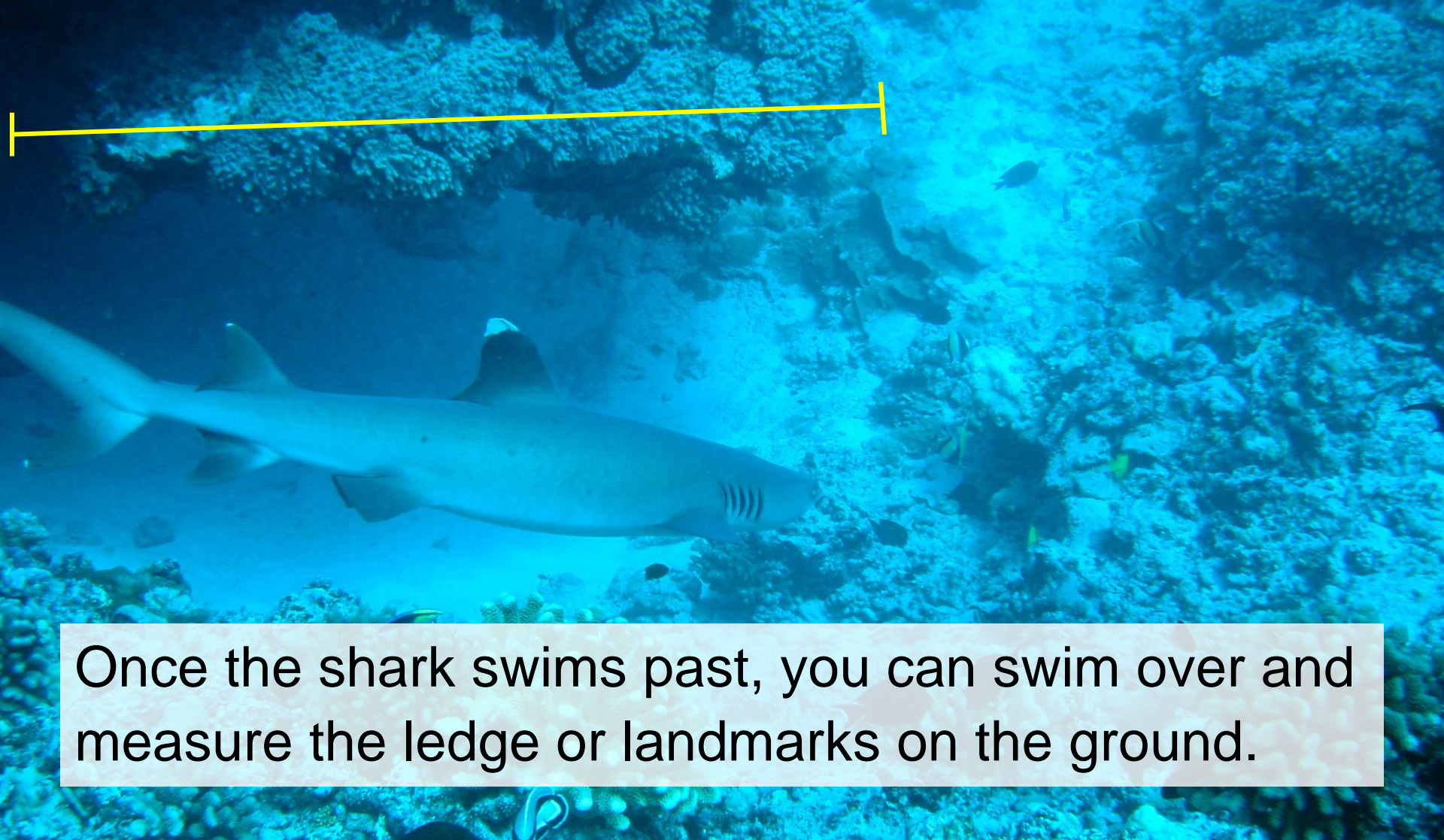Meter stick

Aids to sizing fish

Underwater landmarks

Use underwater structures such as coral heads, boulders, or ledges to measure with your slate or meter stick.

Take note of where a fish's snout and tail are in relation to the landmark, and once it swims past your can take a measurement.
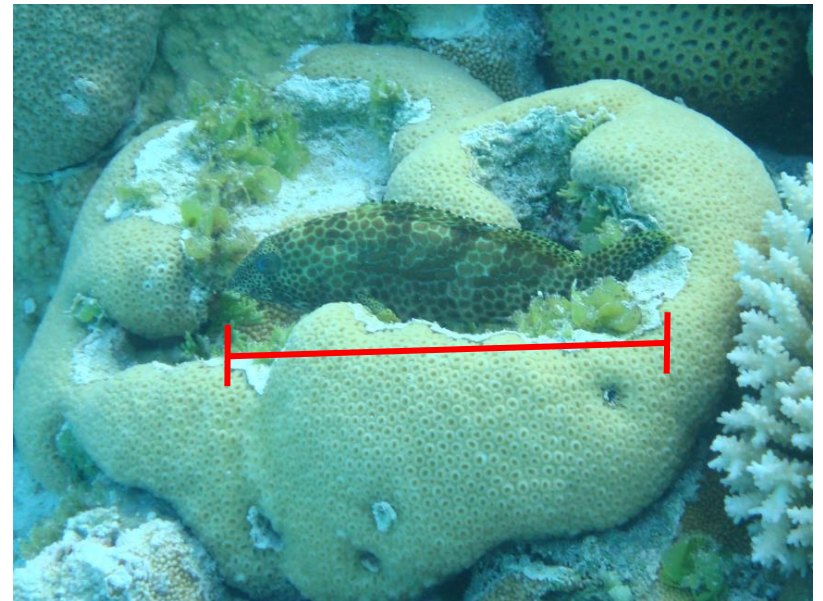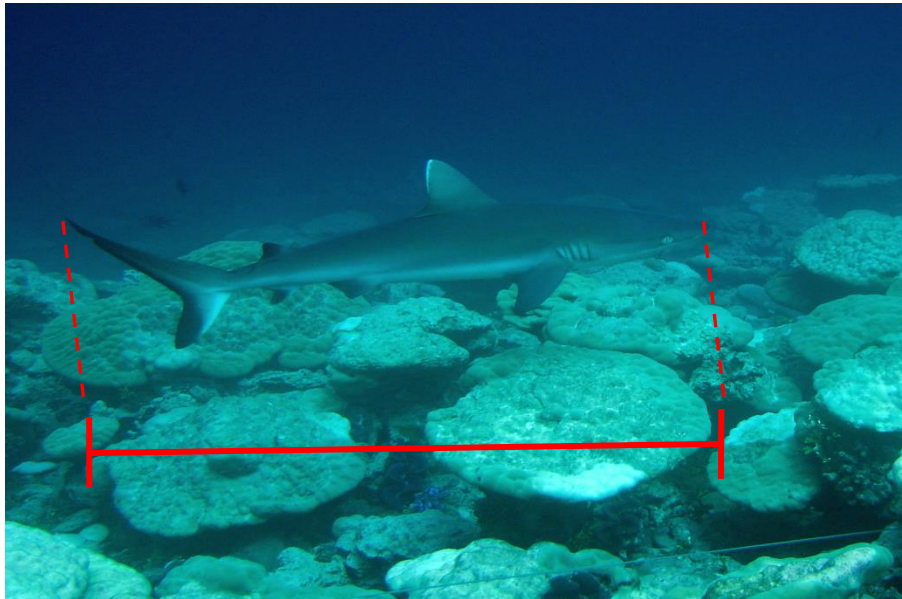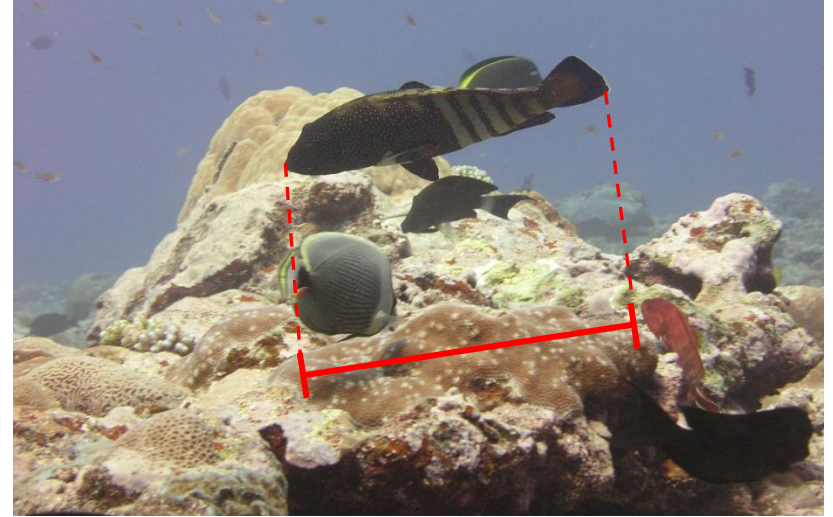
Aids to sizing fish

Underwater landmarks

Once the shark swims past, you can swim over and measure the ledge or landmarks on the ground.

Aids to sizing fish

Underwater landmarks

Aids to sizing fish

Body measurements

Measure yourself! Know what your measurements (cm) are for height, fingertip to fingertip, elbow to fingertip, hand measurement, your buddy's height, etc.

Name: PMA

Thumb to index finger: 16

Thumb to pinkie (shaka): 20

Fingertip to elbow: 40

Fingertip to shoulder: 70

Fingertip to opposite shoulder: 100

Wingspan (fingertip to fingertip): 155

Height: 155

1 meter: Finger to opp. shoulder

Other: Fin width - 20

Buddy info:

Name/height: Kelvin - 167

Name/height: Louise - 166

Name/height: James - 175

Name/height: Kevin L - 200

Name/height: Kosta - 176

Name/height: Kaylyn - 170

Sizing reference sheet

Aids to sizing fish

Body measurements

Underwater you can use your body as a reference tool.

Aids to sizing fish

Body measurements

Kevin's wingspan is 200 cm…

Body measurements

And he's 200 cm tall.

Aids to sizing fish

Body measurements

While Paula is only 155 cm tall.

If you see a shark swimming next to her and it's her size (not counting her fins), it's about 155 cm.

If a shark next to Kevin is as big as he is, it's 200 cm. Pretty big.

Aids to sizing fish

Body measurements

If you know your buddy's measurements...

... you can use them to get an estimate of fish that are close to them.

Aids to sizing fish

Body measurements

But make sure your depth perception is dialed in!

Factors that can affect sizing

Remember, fish can appear larger underwater. They can also sometimes appear *smaller*.

Some factors that may contribute to under and overestimation of size:

Underestimation:

1. Low light
2. Dull body color
3. Poor visibility
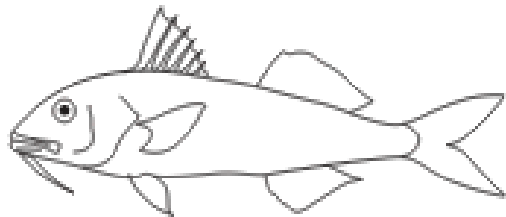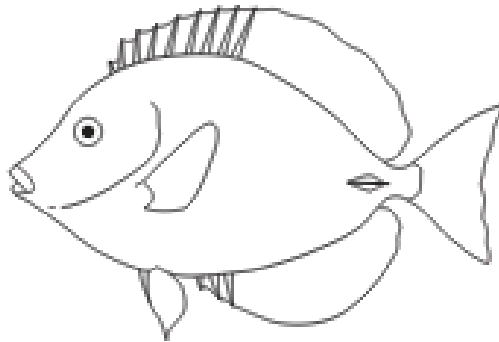4. Objects in foreground
5. Deep-bodied fish

Overestimation:

1. Bright light
2. Bright body color
3. Good visibility
4. Objects in background
5. Elongate fish

As conditions change throughout the day, re-calibrate yourself!

Factors that can affect sizing

Fish body shape can affect how you perceive total length. Which of these fish looks larger to you?

They're actually the same length!

Sizing fish

If you see a fish or fishes that look HUGE to you, take a photo if you can, ideally with something or someone else in the photo as a reference.
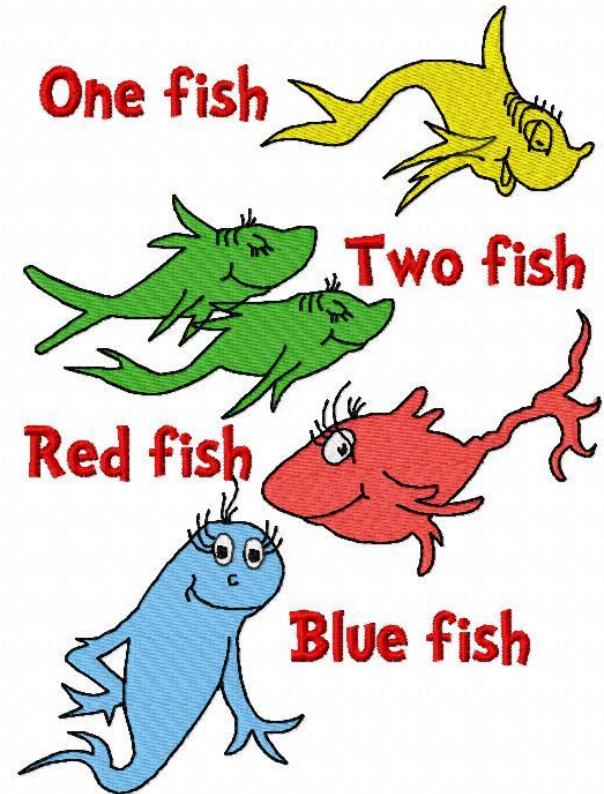
If a question comes up later, there will be photo documentation.
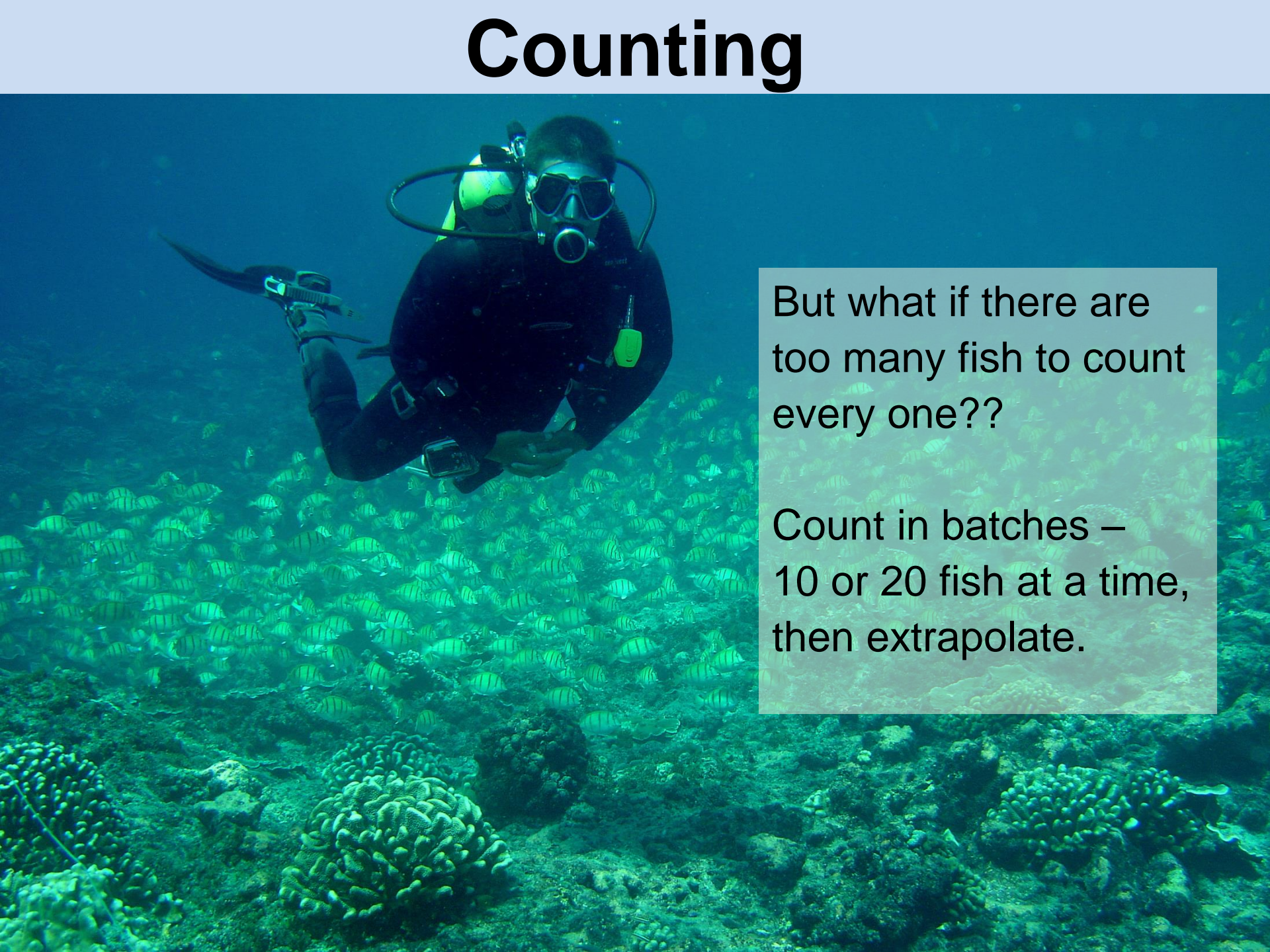
Counting

Fish counts count, too.

Do your best to estimate the exact number of each species of fish, in each size category in your SPC.

One fish

Two fish

Red fish

Blue fish

It's not quite THIS easy…
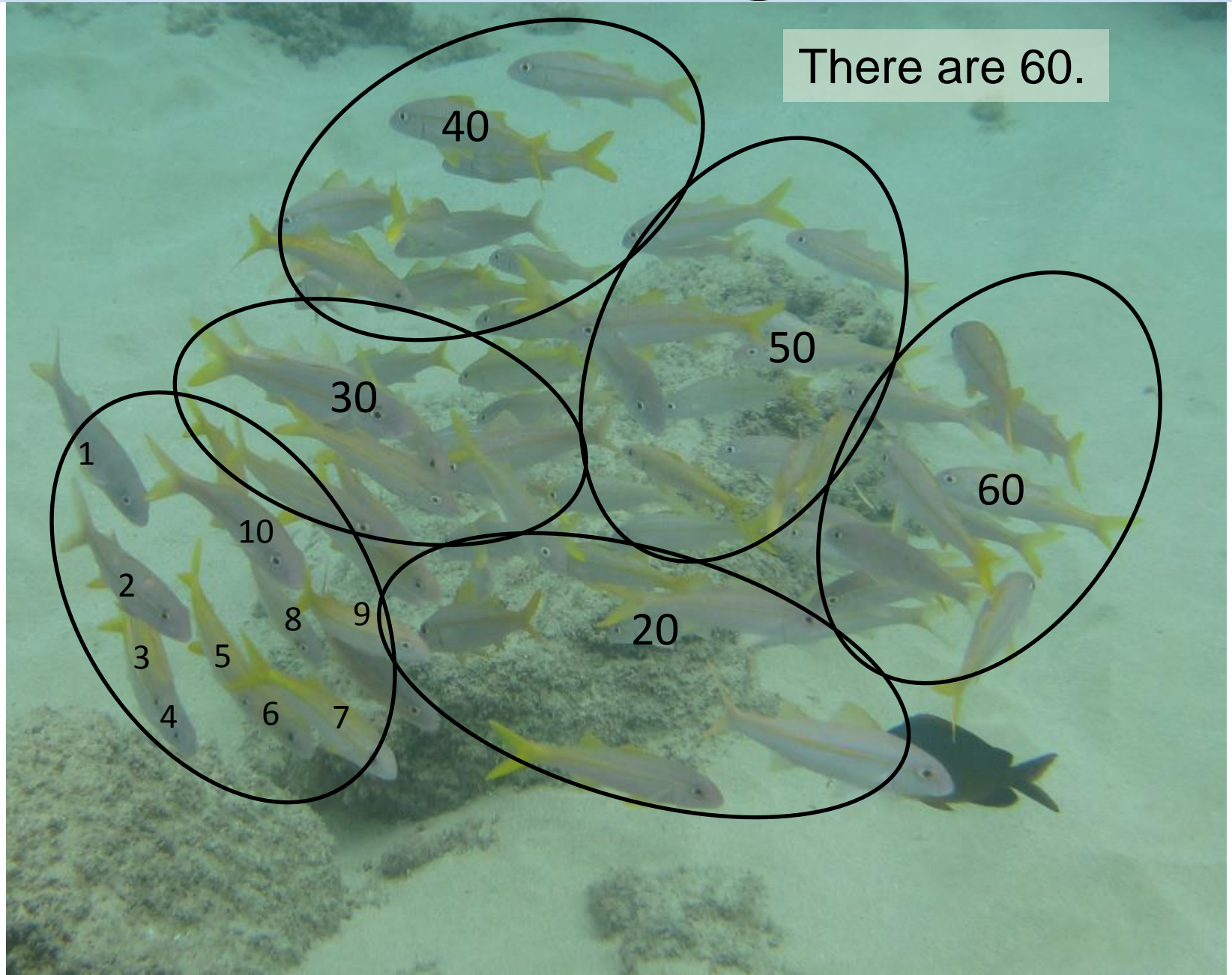
Counting

But what if there are too many fish to count every one??

Count in batches – 10 or 20 fish at a time, then extrapolate.

Counting
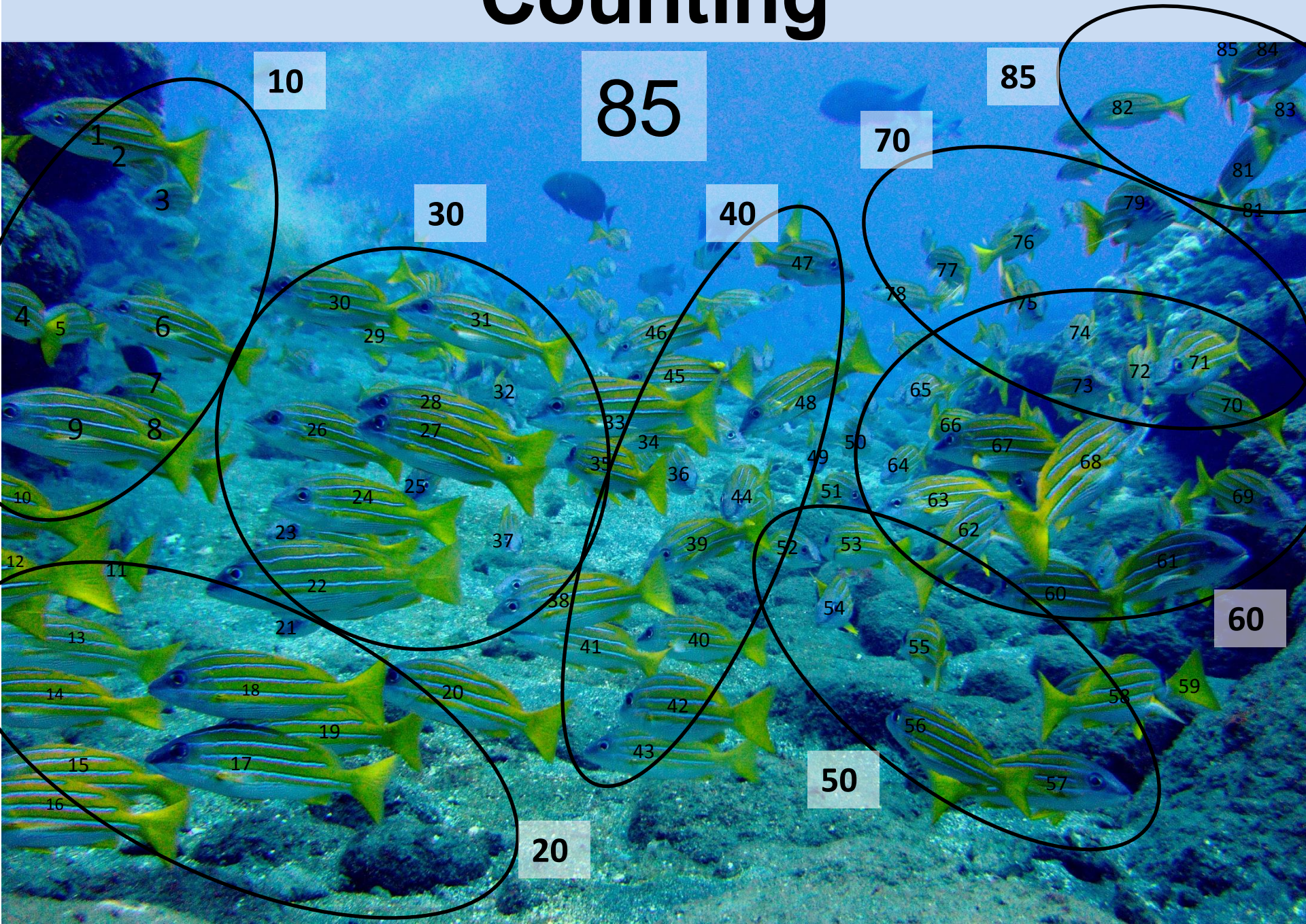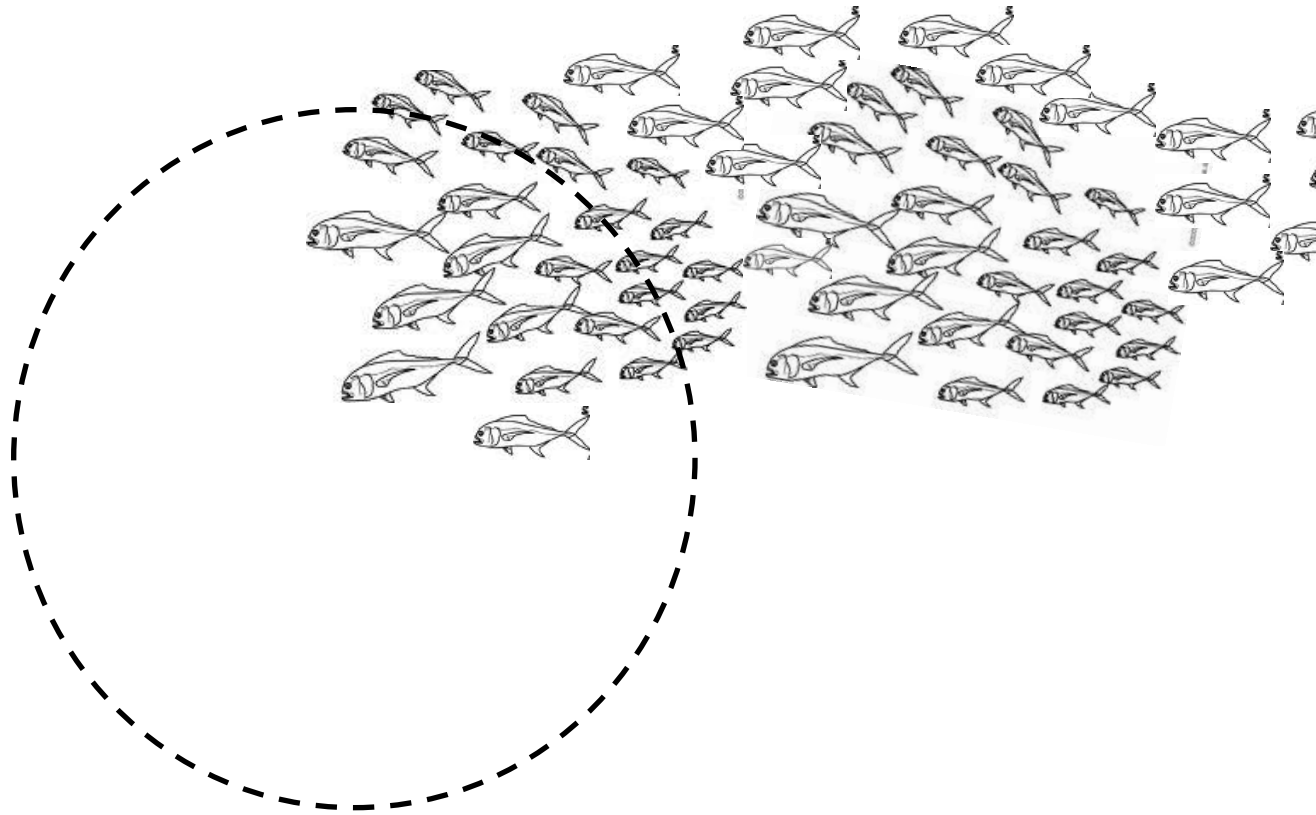

How many *Mulloidichthys vanicolensis*?

Counting

There are 60.

Counting

How many *Lutjanus kasmira* in your cylinder? You're in the center.
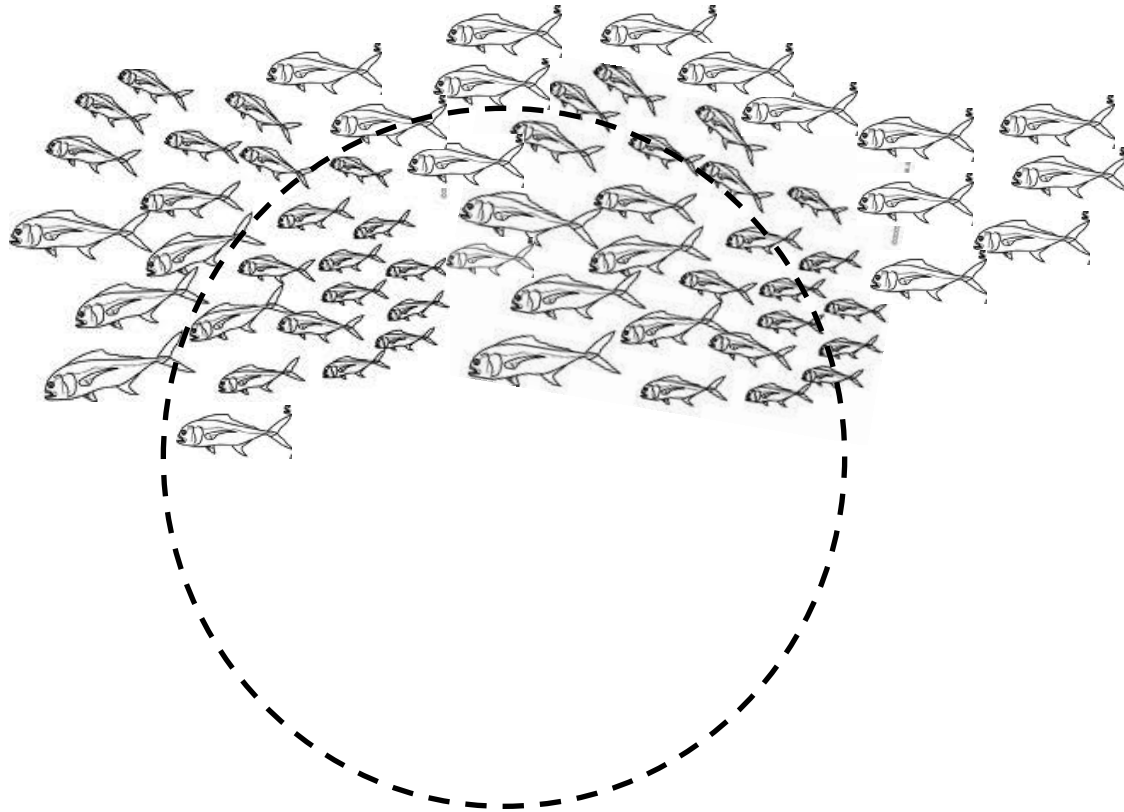
Counting

85

Counting

Question:

What if a large school of fish swims through your transect?
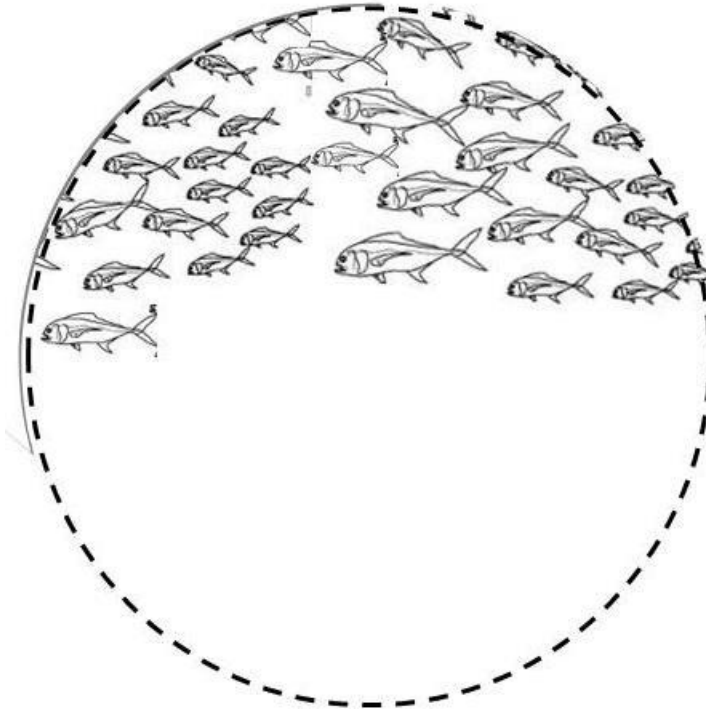
Counting

Answer:

Only size and count the fish inside your cylinder at the moment of the "snapshot."

Here there are 65 total fish in the school; only the 32 fish inside the cylinder should be counted and sized.

Counting

"Click"

Counting

When there are large schools of fish it may be impossible to size every single one, especially on a busy dive.

Acanthurus triostegus

As a placeholder, you may need to "bin," which is giving a range of sizes for a single count.

For example, you might write on your data sheet something like:

ACTR 100 (12-16)

As soon as you have time, you'll have to break that down into something like this, crossing out the binned numbers:

ACTR 100 (12-16) → 30@12, 40@14, 30@16

Counting

Another example of "binning."

Your data sheet at the moment you're counting might look like this:

(The arrow on top is a note to yourself that most of the school is size 34)

Then you would break it down to something like this:

Counting

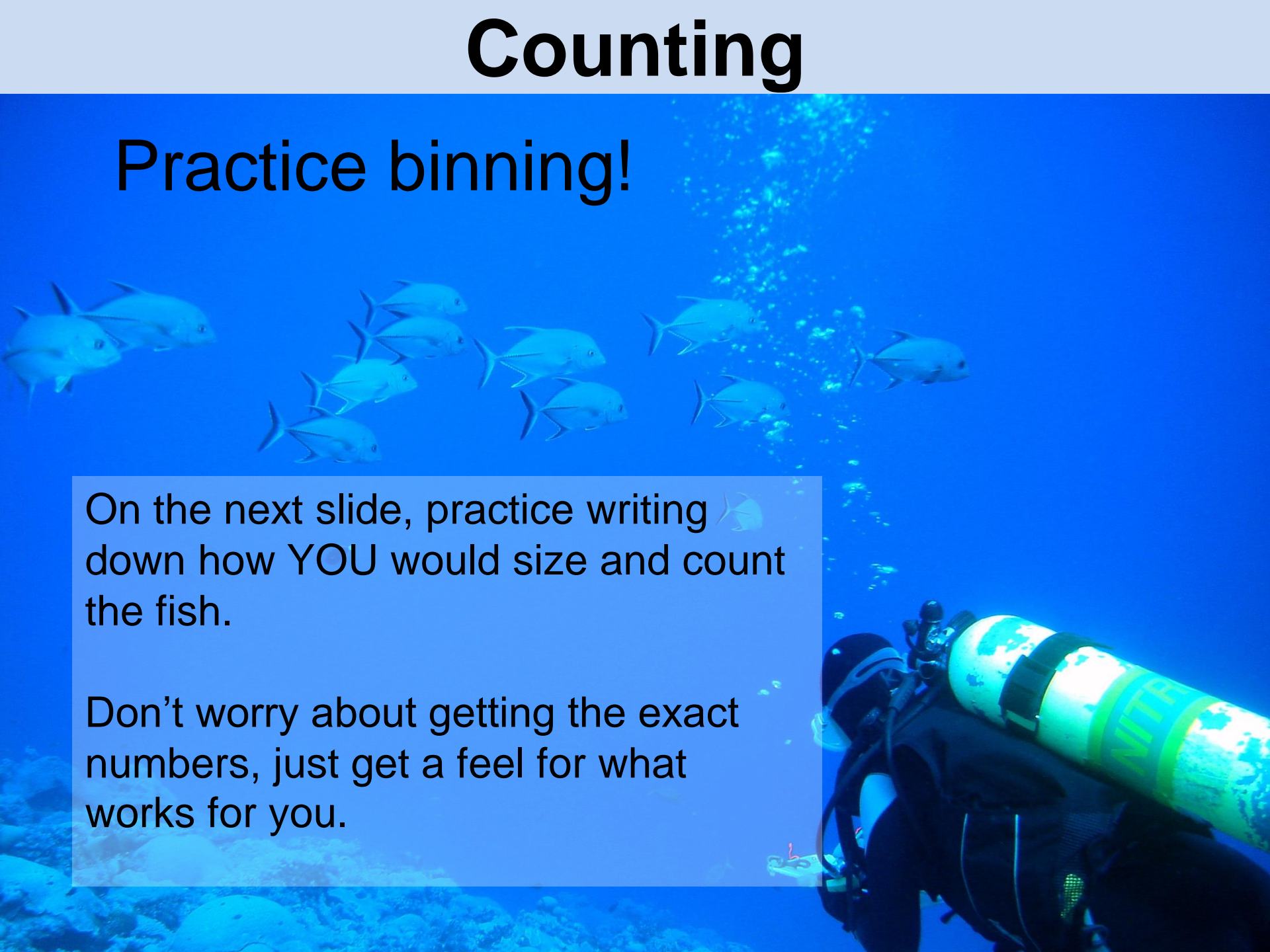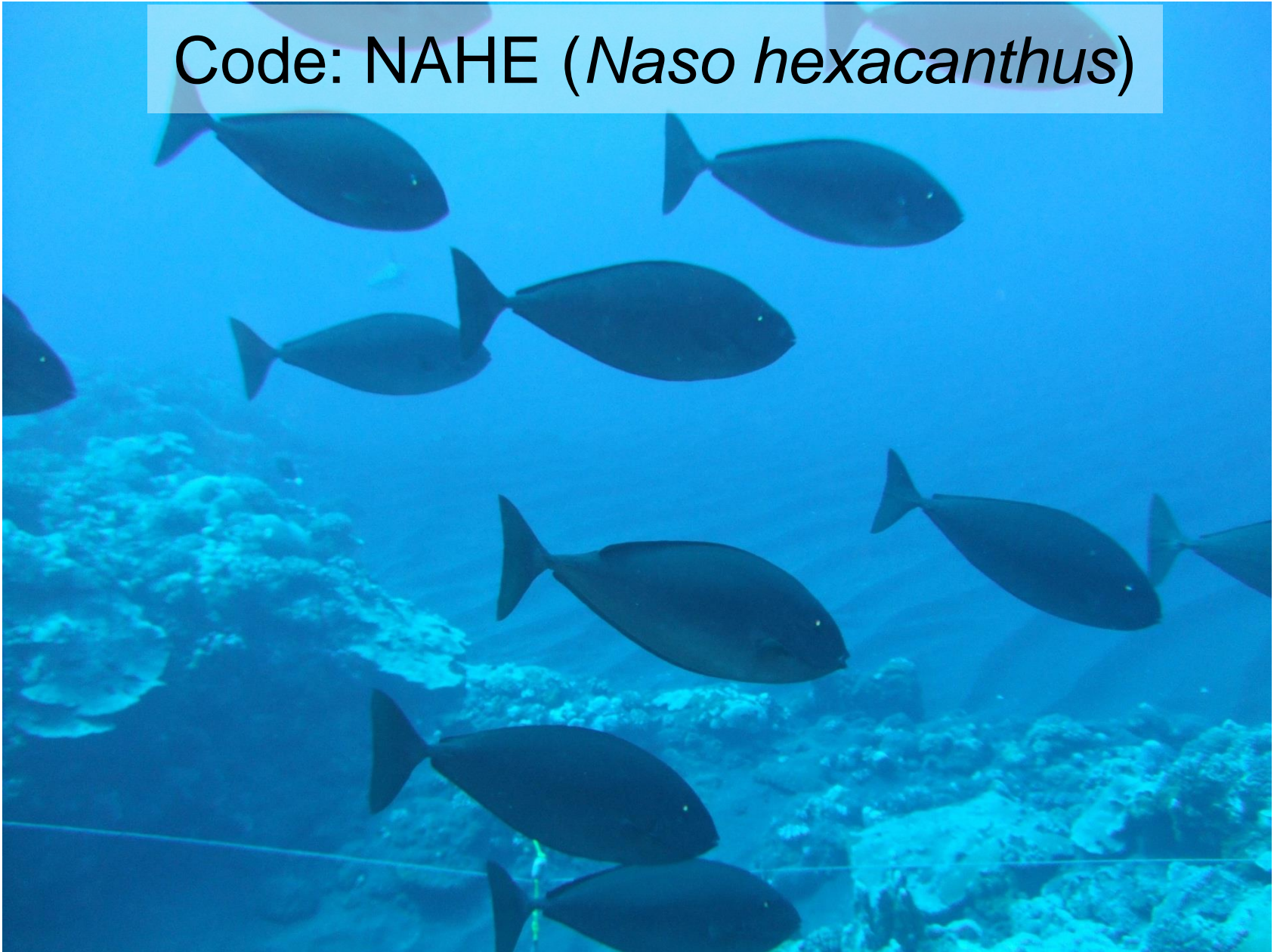## Practice binning!

On the next slide, practice writing down how YOU would size and count the fish.

Don't worry about getting the exact numbers, just get a feel for what works for you.

Counting

Code: NAHE (*Naso hexacanthus*)

Counting

Code: NAHE (*Naso hexacanthus*)

NAHE (10)42-48→ (3)42 (4)46 (3)48

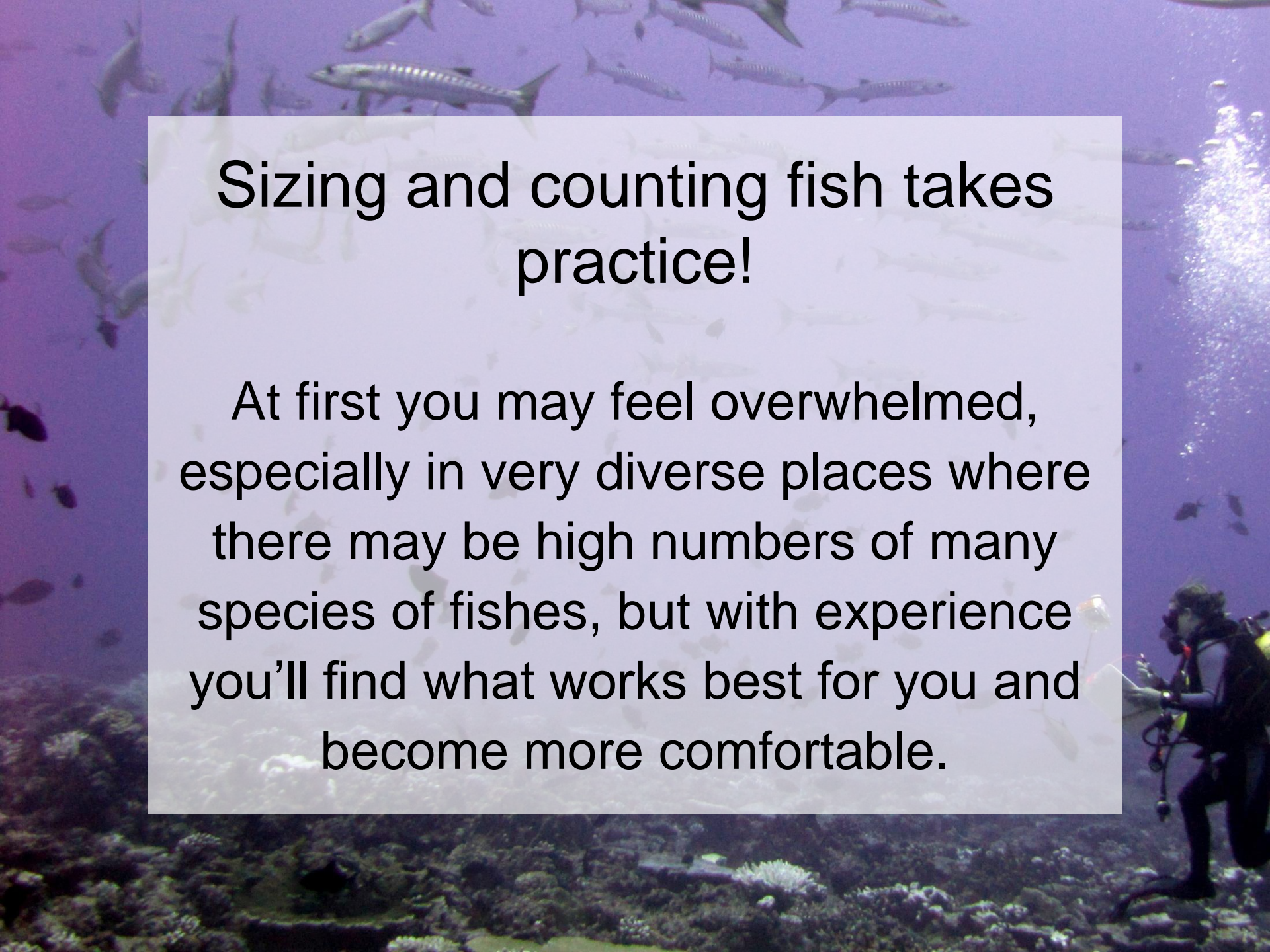Or this:

NAHE 10@42-48 = 5@42 3@47 3@48

Or this:

NAHE 10:42-48 → 3:42 4:46 3:48

It's not important HOW you write the sizes and counts, as long as it's legible and understandable if someone else looks at your sheet.

Sizing and counting fish takes practice!

At first you may feel overwhelmed, especially in very diverse places where there may be high numbers of many species of fishes, but with experience you'll find what works best for you and become more comfortable.